de maximis, inc.
186 Center Street
Suite 290
Clinton, NJ 08809
908-735-9315
908-735-2132 FAX

October 19, 2016

Via Electronic Mail

Jennifer LaPoma
U.S. Environmental Protection Agency, Region II
290 Broadway
New York, New York 10007-1866

Re: Lower Passaic River Study Area (LPRSA) – Revised Draft Baseline Ecological Risk Assessment - Administrative Agreement and Order on Consent for Remedial Investigation/Feasibility Study - CERCLA Docket No. 02-2007-2009

Dear Ms. LaPoma:

The Lower Passaic River Study Area (LPRSA) Cooperating Parties Group (CPG) is delivering the revised Draft *Baseline Ecological Risk Assessment for the Lower Passaic River Study Area*, hereafter referred to as the revised Draft Baseline Ecological Risk Assessment (BERA). The revised Draft BERA has been prepared as part of the 17-mile LPRSA Remedial Investigation/Feasibility Study (RI/FS).

The BERA presents the results of the ecological risk assessment prepared under US Environmental Protection Agency Region 2 (USEPA) oversight and direction, and was conducted in accordance with Section IX.37.d. of the May 2007 *Administrative Agreement and Order on Consent* (AOC). The BERA has been revised pursuant to AOC Section X to address the comments, responses, and directives from USEPA received on May 1, 2015, December 22, 2015, August 4, 2016, September 27, 2016, and other communications with USEPA throughout 2015 and 2016. It is the opinion of the CPG that this revised Draft BERA fully addresses the USEPA's comments, responses and directives. The CPG requests that this letter, along with the revised Draft BERA transmitted on October 7, 2016, be made part of the administrative record.

The CPG continues to maintain, however, that the USEPA has directed the inclusion of overly conservative and unrealistic assumptions, unsupported values and biased analyses that inflate and exaggerate the current ecological risk for the 17-mile LPRSA; while at the same time excluding scientifically valid assumptions and balanced analyses that would provide a more realistic characterization of the current ecological risk to LPRSA biota. As a result, the current draft of the BERA provides an inaccurate and more subjective perception of risk for the LPRSA than did the June 2014 BERA for the entire 17-mile LPRSA. As delivered, the BERA cannot be relied upon to support informed decisions about risk management and the selection of an effective remedial alternative for the LPRSA. Although the CPG has complied with the USEPA's directives in revising this document, it should not be construed that CPG agrees with the results presented in the current version of the BERA. In short, the CPG has agreed to revise the BERA to USEPA's specifications so that the CPG does not have to continue to expend monies to address comments, responses and directives from USEPA.

SUMMARY

The CPG steadfastly maintains that the USEPA's directives on revising the BERA are, in numerous instances, inconsistent with national USEPA guidance, good science and best practices. The CPG stands behind the June 2014 Draft BERA and its response to comments delivered to USEPA on September 15, 2015. The CPG has made the changes in the October 2016 BERA as a result of directives by USEPA. It has become increasingly clear to the CPG that the USEPA has decided to forego good science and established risk assessment practices in favor of achieving, through any means, a perceived risk that supports and does not call into question the USEPA's long-held presumptions of a remedy for the entire 17 miles of the LPRSA.

There are a number of serious, significant deficiencies that compromise the value of the October 2016 BERA as a result of the directives imposed by USEPA, and that are described more fully below. They include:

Screening-Level Ecological Risk Assessment (SLERA) - Using ultra-conservative assumptions, Toxicity Reference Values (TRVs) with little or no scientific basis, and analyses that have little or no scientific validity, the SLERA no longer represents a screening-level assessment. This results in a BERA that is cumbersome, complex and fundamentally no more than a screening-level assessment. Therefore, the BERA no longer functions as a document to support decision making.

Toxicity Reference Values (TRVs) – By requiring the CPG to use TRVs that have little or no scientific validity, weak or not representative endpoints, and little connection to population-level effects, the USEPA has severely weakened the scientific underpinnings of the BERA. Moreover, in some instances it has been impossible to replicate some of the USEPA TRVs. The use of USEPA-directed TRVs has resulted in an overestimation of risks and an inappropriate selection of preliminary chemicals of concern (COCs). The result is a BERA that no longer is a useful document to support the development of remedial alternatives or decision-making.

Metals in Tissues – Given the complexity of metal speciation in the environment and specificity of organismal uptake, the concentration of total metal in an organism is poorly predictive of the fraction of metabolically active metal at the site of toxic action. The CPG disagrees with, and questions the judgement of, the USEPA in requesting this evaluation. USEPA's directive to evaluate metals in fish tissue is inconsistent with the scientific body of literature (Adams et al. 2011; Meador et al. 2011)[1,2].

Common carp – As both an invasive species and an obvious biological stressor, the USEPA should immediately rescind its directives for the BERA to include a quantitative risk characterization of common carp. Specifically, USEPA's directives for common carp result in risk estimates more than twice that of other species and preliminary COCs. It's counterintuitive for the common carp to be the most abundant species present in the LPRSA and have Hazard quotients (HQs) that are significantly higher than other fish species. Common carp are unlikely to be affected by chemistry to the degree that USEPA would have the public believe.

Benthic Invertebrate Evaluation - The USEPA's directives to use protocols to censor the available USEPA-directed reference area data sets, as well as the requirement to use Logistic Regression Model (LRM)-derived sediment thresholds to define sediment quality in the sediment chemistry Sediment Quality Triad line of evidence (LOE), have fundamentally (1) weakened the methodology for conducting the benthic community risk assessment, and (2) altered the ability of the risk analysis to appropriately identify

[1] Adams W, Blust R, Borgmann U, Brix K, DeForest D, Green A, McGeer J, Meyer J, Paquin P, Rainbow P, Wood C. 2011. Utility of tissue residues for predicting effects of metals on aquatic organisms. Integr Environ Assess Manage 7(1):75-98.

[2] Meador J, Adams WJ, Escher BI, McCarty LS, McElroy AE, Sappington KG. 2011. The tissue residue approach for toxicity assessment: Findings and critical reviews from a Society of Environmental Toxicology and Chemistry Pellston workshop. Integr Environ Assess Manage 7(1):2-6.

risks to the benthic community posed by an unpermitted release of hazardous substances.

The remainder of this transmittal letter presents detailed support for the CPG's position that the current BERA is flawed and unusable to support the identification of an effective remedial alternative that is protective of the environment.

SLERA – UNBALANCED AND OVERLY CONSERVATIVE

In USEPA's December 2015 response to comments, there were numerous comments directing that additional conservatism be added to an already very conservative SLERA. These directives included screening all species with the same screening value, regardless of whether or not it was developed for that particular species; adding species such as common carp, which were never included as an assessment endpoint, to evaluate from a management perspective; adding additional TRVs, including TRVs from the 8-mile focused feasibility study (FFS) that have little scientific basis; screening for metals (regulated by fish) in fish tissue; and adding extrapolation factors. This has resulted in the current SLERA no longer functioning as a screening step to identify likely chemicals of potential ecological concern (COPECs). As a result, additional COPECs more easily pass through the SLERA screen. Therefore, the BERA is no longer consistent with USEPA guidance that includes a conservative screening (SLERA) and a more site-specific assessment to identify a true list of COCs that are likely risk drivers. Given the comments on the BERA, the current BERA is now closer to a SLERA and of limited use.

REVISED EXPOSURE AREAS – INCONSISTENT WITH THE 2014 ERA AND ARBITRARY

At the USEPA's direction (per discussion with Region 2 during a May 21, 2015, teleconference), CPG provided proposed exposure areas per receptor as well as exposure areas that had already been evaluated in the draft BERA (see table below). Smaller than site-wide exposures are included for all bird and mammal receptors as part of either the risk characterization or the uncertainty evaluation for the revised BERA. As the CPG does not agree that smaller, non-ecologically relevant exposure areas are relevant and appropriate, and believes that they will lead to inaccurate estimates of risk, the text of the revised BERA reflects the uncertainties and limitations of this approach.

CPG exposure area/dataset for 2014 draft BERA wildlife EPCs

Focal Species	Exposure Area			Supporting documentation/Notes
	Prey	Sediment	Surface Water	
Spotted Sandpiper	Site-wide	Site-wide mudflats	> RM 8	Sediments deeper than mudflat areas do not represent potential shorebird foraging areas; spotted sandpiper require exposed areas (e.g., mudflats or sandbars) with firm, fine grained (e.g., silt or sand) sediment for feeding (Oring et al. 1997)[3]; these habitats found throughout the LPRSA during the avian surveys (Windward 2011, [in prep]; BBL 2002)[4,5,6]. Although they have a lower preference for areas near human activity, their habitat is generally not limited by land use or shoreline features (Windward 2011, [in prep])[7,8].

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3 Oring LW, Gray EM, Reed JM. 1997. Spotted sandpiper (*Actitis macularius*). In: Poole A, ed, The birds of North America online. Cornell Laboratory of Ornithology, Ithaca, NY, Available from: http://bna.birds.cornell.edu/bna/species/289.

4 Windward. 2011. Avian community survey data report for the Lower Passaic River Study Area summer and fall 2010 field efforts. Final. Prepared for Cooperating Parties Group, Newark, NJ. August 8, 2011. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

5 Windward. [in prep]. Avian community survey data report for the Lower Passaic River Study Area winter and spring 2011 field efforts. Draft. Prepared for Cooperating Parties Group, Newark, NJ. Submitted to USEPA November 20, 2015. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

6 BBL. 2002. Passaic River Study Area avian survey (1999-2000). Draft. Prepared for Tierra Solutions, Inc. . BBL (Blasland, Bouck & Lee, Inc.), Syracuse, NY.

7 Windward. 2011. Avian community survey data report for the Lower Passaic River Study Area summer and fall 2010 field efforts. Final. Prepared for Cooperating Parties Group, Newark, NJ. August 8, 2011. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

8 Windward. [in prep]. Avian community survey data report for the Lower Passaic River Study Area winter and spring 2011 field efforts. Draft. Prepared for Cooperating Parties Group, Newark, NJ. Submitted to USEPA November 20, 2015. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

CPG exposure area/dataset for 2014 draft BERA wildlife EPCs

Focal Species	Exposure Area			Supporting documentation/Notes
	Prey	Sediment	Surface Water	
	Mudflats by reach	Mudflats by reach	> RM 8	2-mile exposure area may represent appropriate scale for foraging during breeding (Oring et al. 1997)[9]. Mudflat by reach exposure area for prey and sediment was included in the 2014 BERA uncertainty discussion.
Great Blue Heron	Site-wide	Site-wide mudflats	> RM 8	Great blue heron found throughout the LPRSA during the avian surveys (Windward 2011, [in prep]; BBL 2002)[10,11,12], and they showed no preference among fresh, brackish, or saltwater habitats (Kushlan 1978; Willard 1977; Chapman and Howard 1984)[13,14,15]. Sediments deeper than mudflat areas do not represent potential heron foraging areas; heron generally require shallow water for hunting for prey. Fish prey may forage outside of mudflat areas.

[9] Oring LW, Gray EM, Reed JM. 1997. Spotted sandpiper (*Actitis macularius*). In: Poole A, ed, The birds of North America online. Cornell Laboratory of Ornithology, Ithaca, NY, Available from: http://bna.birds.cornell.edu/bna/species/289.

[10] Windward. 2011. Avian
community survey data report for the Lower Passaic River Study Area summer and fall 2010 field efforts. Final. Prepared for Cooperating Parties Group, Newark, NJ. August 8, 2011. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

[11] Windward. [in prep]. Avian community survey data report for the Lower Passaic River Study Area winter and spring 2011 field efforts. Draft. Prepared for Cooperating Parties Group, Newark, NJ. Submitted to USEPA November 20, 2015. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

[12] BBL. 2002. Passaic River Study Area avian survey (1999-2000). Draft. Prepared for Tierra Solutions, Inc. . BBL (Blasland, Bouck & Lee, Inc.), Syracuse, NY.

[13] Kushlan JA. 1978. Feeding ecology of wading birds. In: Sprunt A, Oge J, Winckler S, eds, Wading birds, research report No. 7. National Audubon Society, New York, NY, pp 249-297.

[14] Willard DE. 1977. The feeding ecology and behavior of five species of herons in southeastern New Jersey. Condor 79:462-470.

[15] Chapman BR, Howard RJ. 1984. Habitat suitability index models: great egret. FWS/OBS-82/10.78. US Fish and Wildlife Service, Washington, DC.

CPG exposure area/dataset for 2014 draft BERA wildlife EPCs

Focal Species	Exposure Area			Supporting documentation/Notes
	Prey	Sediment	Surface Water	
Belted Kingfisher	> RM 6	> RM 6	> RM 8	In general, belted kingfisher breeding habitat was found to be limited in the lower 6 mi of the Passaic River (Baron 2011)[16]; areas above the lower 6 mi have suitable habitat and may support breeding pairs (Ludwig et al. 2010)[17]. Fish and crabs may forage outside of mudflat areas, so not limited to mudflats only.

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16 Baron L. 2011. Personal communication (phone conversation with Thai Do, Windward Environmental, regarding 2006 belted kingfisher survey in the LPRSA). Project Manager, US Army Corps of Engineers. February 9, 2011.

17 Ludwig DF, Iannuzzi J, Iannuzzi TJ, Shisler JK. 2010. Spatial and temporal habitat use patterns by water birds in an urban estuarine ecosystem: implications for ecosystem management and restoration. Human Ecol Risk Assess 16:163-184.

CPG exposure area/dataset for 2014 draft BERA wildlife EPCs

Focal Species	Exposure Area			Supporting documentation/Notes
	Prey	Sediment	Surface Water	
Mink	> RM 10 (SFF); Site-wide (non SFF)	> RM 10	> RM10	Mink are generally limited to natural shorelines with access to water (Allen 1986)[18] and will dive for prey at depths of less than 10 ft. (Harrington et al. 2012; Hays et al. 2007)[19,20]. Mink prefer areas with dense riparian or shrub-scrub vegetation with canopy and tend to avoid areas near human activity or limited vegetation, including areas of residential/recreational land use (Allen 1986; USEPA 2002a)[21,22]. This suggests that mink are more likely to be restricted to the least disturbed/developed portions of the LPRSA (i.e., from about RM 10 and upstream).
	Site-wide	Site-wide	> RM 8	Site-wide considers the potential use below RM 10, although this is unlikely based on the habitat present. Potential fish prey and crabs may forage outside of mudflat areas. A site-wide prey and sediment exposure area was included in the 2014 BERA uncertainty discussion.

[18] Allen AW. 1986. Habitat suitability index models: mink, revised. Biol rep 82(10.127). US Fish and Wildlife Service, Washington, DC.

[19] Harrington LA, Hays GC, Fasola L, Harrington AL, Righton D, Macdonald DW. 2012. Dive performance in a small-bodied, semi-aquatic mammal in the wild. J Mammal 93(1):198-210.

[20] Hays GC, Forman DW, Harrington LA, Harrington AL, Macdonald DW, Righton D. 2007. Recording the free-living behaviour of small-bodied, shallow-diving animals with data loggers. J Anim Ecol 76:183-190.

[21] Allen AW. 1986. Habitat suitability index models: mink, revised. Biol rep 82(10.127). US Fish and Wildlife Service, Washington, DC.

[22] USEPA. 2002. GE/Housatonic River site in New England. Rest of river ERA. Species profile: mink [online]. US Environmental Protection Agency, Boston, MA. [Cited 2/10/11.] Available from: http://www.epa.gov/ne/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_mink.pdf.

CPG exposure area/dataset for 2014 draft BERA wildlife EPCs

Focal Species	Exposure Area			Supporting documentation/Notes
	Prey	Sediment	Surface Water	
River otter	Site-wide	Site-wide	> RM 8	River otter can have large home ranges up to 22.5 km long (Spinola et al. 1999)[23] and feed on larger fish that are not restricted to one portion of the LPRSA. River otter feed in deep water as well as shallow water (USEPA 2003b; Cote et al. 2008)[24,25].
	> RM 10 (SFF); Site-wide (non SFF)	> RM 10	> RM 8	The literature indicates that river otter will generally not use areas with human activity, including areas of residential and recreational land use (Boyle 2006; USEPA 2003b; Melquist and Hornocker 1983)[26,27,28]. A site-wide non-small forage fish, >RM 10 small forage fish, and >RM 10 sediment exposure area was included in the 2014 BERA uncertainty discussion.

[23] Spinola RM, Serfass TL, Brooks RP. 1999. Radiotelemetry study: river otters reintroduction at Letchworth State Park. Progress report no. 1. New York State Department of Environmental Conservation, New York River Otter Project, and New York State Office of Parks, Recreation, and Historic Preservation, Albany, NY.

[24] USEPA. 2003. GE/Housatonic River site in New England. Rest of river ERA. Species profile: river otter [online]. US Environmental Protection Agency, Boston, MA. [Cited 1/26/11.] Available from: http://www.epa.gov/ne/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_river_otter.pdf.

[25] Cote D, Gregory RS, Stewart HMJ. 2008. Size-selective predation by river otter (*Lontra canadensis*) improves refuge properties of shallow coastal marine nursery habitats. Can J Zool 86:1324-1328.

[26] Boyle SL. 2006. North American river otter (*Lontra canadensis*): a technical conservation assessment. BIO-Logic Environmental, Montrose, CO.

[27] USEPA. 2003. GE/Housatonic River site in New England. Rest of river ERA. Species profile: river otter [online]. US Environmental Protection Agency, Boston, MA. [Cited 1/26/11.] Available from: http://www.epa.gov/ne/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_river_otter.pdf.

[28] Melquist WE, Hornocker MG. 1983. Ecology of river otters in west central Idaho. In: Kirkpatrick RL, ed, Wildlife monographs. Vol 83. The Wildlife Society, Bethesda, MD, p 60.

Arbitrarily dividing the river is not sound science and is inconsistent with the technical direction given by USEPA previously. Exposure areas should be, and were in the June 2014 BERA, based on the results of site-specific surveys and literature reviews, the development of life history profiles for each receptor, and site-specific habitat characteristics and chemical characterization. The USEPA-approved quality assurance project plans (QAPPs) were not designed to evaluate areas as small as single mudflats, so an analysis at this level of detail will result in evaluations based on maximum concentrations (where data are insufficient), which will result in an outcome similar to what is captured in the SLERA.

Furthermore, the USEPA comment directs CPG to take an approach that is inconsistent with the ecological risk assessment presented in USEPA Region 2's 8-mile FFS RI ((Louis Berger et al. 2014);[29] see Appendix D, Section 4.2.1, paragraph 1). The approach of simply cutting the river into geographical exposure units also conflicts with USEPA Region 2's January 2013 comment No. 107 on the Newark Bay Problem Formulation Document exposure areas: "*Habitat, rather than geomorphic and geographic areas, is a much better way to describe the exposure areas for ecological receptors, and should be referenced here.*"

TOXICITY REFERENCE VALUES (TRVS) – USEPA TRVS ARE INDEFENSIBLE AND INAPPROPRIATE

USEPA's June 2015 comments on the 2014 BERA required that TRVs based on previous documents, including the 2014 FFS Ecological Risk Assessment, be used, despite the CPG's legitimate concerns over the defensibility of the USEPA values. The CPG is concerned that there are general uncertainties associated with using laboratory toxicity studies to characterize risk to LPRSA species, including the following:

- The reported adverse effects do not necessarily occur in all species.
- The concentrations that elicit adverse effects can vary greatly among species.

[29] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

- Concentrations and exposure conditions that elicit adverse effects in the laboratory may not be representative of concentrations and conditions to which organisms are exposed *in situ*.
- Some of the endpoints evaluated and reported in laboratory studies may not have meaningful relevance to an organism's likelihood of surviving or successfully reproducing.
- Even if individual organisms experience ecologically relevant effects, these effects may not be predictive of population-level responses in a complete ecological context in which time-varying exposures among individuals and population dynamics are also a function of the effects of other co-occurring natural and anthropogenic stressors. This is particularly important since the BERA, pursuant to USEPA guidance, is an assessment of population-level risks.

The CPG reviewed all USEPA-directed TRVs for invertebrates, fish, birds, and mammals for acceptability for use in the LPRSA BERA. The CPG attempted to replicate values per instruction provided in Battelle (2005)[30] and Louis Berger et al. (2014)[31]. Several USEPA-directed TRVs for fish, birds, and mammals could not be replicated. Additionally, CPG determined several USEPA-directed TRVs to be inappropriate for use in the LPRSA BERA, because the associated endpoints are not a direct measurement of survival, growth or reproduction. As such, CPG does not agree that these should be considered in the evaluation of LPRSA baseline risks. The following USEPA-directed TRVs are deemed inappropriate by the CPG; they are presented by endpoint:

Benthic Invertebrate TRVs

TCDD – The USEPA directed the inclusion of benthic invertebrate TRVs based on Wintermyer and Cooper (2003)[32],a 10-month field study of adult eastern oysters

[30] Battelle. 2005. Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers. Battelle, Duxbury, MA.

[31] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[32] Wintermyer ML, Cooper KR. 2003. Dioxin/furan and polychlorinated biphenyl concentrations in eastern oyster (*Crassostrea virginica* Gmelin) tissues and the effects on egg fertilization and development. J Shellfish Res 22(3):737-746.

transplanted to Newark Bay, Arthur Kill, and Sandy Hook, New Jersey that examined reproductive endpoints measuring the success rate of egg fertilization and early development of those fertilized eggs in a 48-hr assay. The USEPA lowest-observed-adverse-effect level (LOAEL) TRV of 1.3 ng/kg ww is based on oysters deployed at the Arthur Kill site, where 23% fertilization success occurred, compared to the USEPA no-observed-adverse-effect level (NOAEL) TRV of 0.15 ng/kg ww for the 54% fertilization success rate of oysters deployed at Sandy Hook.

This study measured polychlorinated biphenyls (PCBs) and dioxins/furans from oysters at two locations near Newark Bay. The reported tissue concentrations are based on <u>one composite</u> sample of seven oysters from each site. The reproductive endpoint measuring early development of fertilized eggs is based on <u>one sample</u> and does not provide any measure of variability in tissue concentrations. The toxic equivalent (TEQ) approach of evaluating polychlorinated dibenzo-*p*-dioxins/polychlorinated dibenzofurans (PCDDs/PCDFs) and PCBs is highly uncertain for evaluating the toxicity to invertebrates, given that toxic equivalency factors (TEFs) are available for only fish, birds, and mammals. This study is not an appropriate basis to develop a TRV for benthic invertebrates.

PCBs – A USEPA PCB TRV for benthic invertebrate tissue was based on two studies: Chu et al. (2000)[33] and Chu et al. (2003)[34]. The first study examined PCB uptake and accumulation in eastern oysters exposed for 30 days to a contaminated algal diet and measured total PCB accumulation within the oysters. The second study examined PCB accumulation and adverse reproductive effects measured by number of spawned oysters at day 76 of the experiment. The USEPA LOAEL TRV of 26 µg/kg ww is based on the egg tissue concentration (671 ng PCB/g egg tissue) reported in Chu et al. (2000)[35] after 30 days of exposure to 1.0 µg PCBs, and correlated to the effect of a decreased number of spawned oysters after 56, 61, and 76 days of daily exposure to 0.35 µg PCBs

[33] Chu F-LE, Soudant P, Cruz-Rodriguez LA, Hale RC. 2000. PCB uptake and accumulation by oysters (*Crassostrea virginica*) exposed via a contaminated algal diet. Mar Environ Res 50:217-221.
[34] Chu F-LE, Soudant P, Hale RC. 2003. Relationship between PCB accumulation and reproductive output in conditioned oysters *Crassostrea virginica* fed a contaminated algal diet. Aqua Tox 65:293-307.
[35] Chu F-LE, Soudant P, Cruz-Rodriguez LA, Hale RC. 2000. PCB uptake and accumulation by oysters (*Crassostrea virginica*) exposed via a contaminated algal diet. Mar Environ Res 50:217-221.

reported in Chu et al. (2003)[36]. The USEPA NOAEL TRV of 8.0 µg/kg ww is based on the egg tissue concentration (200 ng PCB/g egg tissue) reported in the same study after 30 days of exposure to 0.10 µg PCBs, and correlated to the no-adverse-effect on reproduction observed by Chu et al. (2003)[37]. Chu et al. (2003)[38] noted that no dose-responsive relationship was observed in the number of spawned females. It should be noted that no PCB analysis was conducted on eggs in the present study, and that Chu et al. (2003)[39] states that PCB concentrations in this study might have exceeded those found in Chu et al. (2000)[40]. These studies use different doses and exposure conditions and assume a linear relationship between dose and egg tissue. The linear interpolation could not be recreated from the FFS or from individual studies.

LPAHs – The USEPA's total low-molecular-weight polycyclic aromatic hydrocarbon (LPAH) invertebrate tissue TRV was based on a study (Emery and Dillon 1996)[41] with unclear results, which calls into question the appropriateness of using the reported NOAELs and LOAELs (78 and 780 µg/kg ww, respectively) for risk calculations. The reported effect of a single PAH (phenanthrene) was not clearly adverse compared to the environmentally relevant seawater control; a 35% decrease in growth and fecundity was reported at the LOAEL relative to carrier control [acetone], no different from the seawater control.

HPAHs – A LOAEL and NOAEL of 220 and 22 µg/kg ww, respectively, were directed as TRVs by the USEPA for invertebrate high-molecular-weight polycyclic aromatic

[36] Chu F-LE, Soudant P, Hale RC. 2003. Relationship between PCB accumulation and reproductive output in conditioned oysters *Crassostrea virginica* fed a contaminated algal diet. Aqua Tox 65:293-307.
[37] Chu F-LE, Soudant P, Hale RC. 2003. Relationship between PCB accumulation and reproductive output in conditioned oysters *Crassostrea virginica* fed a contaminated algal diet. Aqua Tox 65:293-307.
[38] Chu F-LE, Soudant P, Hale RC. 2003. Relationship between PCB accumulation and reproductive output in conditioned oysters *Crassostrea virginica* fed a contaminated algal diet. Aqua Tox 65:293-307.
[39] Chu F-LE, Soudant P, Hale RC. 2003. Relationship between PCB accumulation and reproductive output in conditioned oysters *Crassostrea virginica* fed a contaminated algal diet. Aqua Tox 65:293-307.
[40] Chu F-LE, Soudant P, Cruz-Rodriguez LA, Hale RC. 2000. PCB uptake and accumulation by oysters (*Crassostrea virginica*) exposed via a contaminated algal diet. Mar Environ Res 50:217-221.
[41] Emery VL, Dillon TM. 1996. Chronic toxicity of phenanthrene to the marine polychaete worm, *Nereis (Neanthes) arenaceodentata*. Bull Environ Contam Toxicol 56(2):265-270.

hydrocarbon (HPAH) tissue (Louis Berger et al. 2014)[42]. These TRVs are based on a study conducted by Eertman et al. (1995)[43]. This was a four-week toxicity test examining adverse effects of fluoranthene on gametogenesis in blue mussels. Abnormal gametogenesis is not a direct measure of reproductive success at a population level.
Total DDx – USEPA's total DDx (sum of all six DDT isomers) TRVs for invertebrate tissue (a LOAEL TRV of 130 µg/kg ww and a NOAEL TRV of 60 µg/kg ww) are considered to be highly uncertain because the study on which the NOAEL and LOAEL are based (Nimmo et al. 1970)[44] reported a 17% mortality rate in the untreated control group (and 30% mortality in the treated group).

Dieldrin – The USEPA's dieldrin TRV for invertebrate tissue (a LOAEL TRV of 8.0 µg/kg ww and a NOAEL TRV of 1.6 µg/kg ww) are based on a study by Parrish et al. (1973)[45] wherein survival of pink shrimp was measured during a 96-hour toxicity test. The use of an acute TRV for determining risk to the benthic invertebrate community is considered highly uncertain.

Fish Tissue TRVs

PCBs – A USEPA PCB TRV for fish was based on the behavioral endpoint of smolt seawater preference in Atlantic salmon during a three-week exposure to Aroclor-1254 (Lerner et al. 2007)[46]. The NOAEL and LOAEL of 170 and 530 µg/kg ww, respectively, were derived based on a decreased smolt seawater preference for Atlantic salmon exposed to 1 and 10 µg/L Aroclor-1254, respectively. CPG does not agree that these are appropriate TRVs for the evaluation of LPRSA baseline ecological risks; the smolt

[42] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[43] Eertman RHM, Groenink CL, Sandee B, Hummel H, Small AC. 1995. Response of the blue mussel *Mytilus edulis* L. following exposure to PAHs or contaminated sediment. Mar Environ Res 39:169-173.
[44] Nimmo DR, Wilson Jr AJ, Blackman RR. 1970. Localization of DDT in the body organs of pink and white shrimp. Bull Environ Contam Toxicol 5(4):333-341.
[45] Parrish PR, Couch JA, Forester J. 1973. Dieldrin: Effects on several estuarine organisms. Proceedings of the 27th Annual Conference of the Southeastern Association of Game and Fish Commissioners. pp 427-434.
[46] Lerner DT, Bjornsson BT, McCormick SD. 2007. Effects of aqueous exposure to polychlorinated biphenyls (Aroclor 1254) on physiology and behavior of smolt development of Atlantic salmon. Aqua Tox 81:329-336.

seawater preference of Atlantic salmon is not relevant to the LPRSA or selected focal or non-focal fish receptors.

Total LPAHs and HPAHs - The use of USEPA's directed LPAH and HPAH fish tissue TRVs, as documented in Table 3-16 of the revised BERA Appendix A (SLERA), is inappropriate because predicting risks to fish from PAHs is highly uncertain, as PAHs are rapidly metabolized and excreted by fish following uptake.

Total DDX – The USEPA's total DDx TRVs for fish tissue are inappropriate for assessing baseline risks because of the inclusion of certain studies in the LOAEL TRV development that are not directly relevant to assessing LPRSA fish. As reported by Beckvar et al. (2005)[47], 10 LOAELs were selected to derive a total DDx 5th percentile LOAEL for 9 species of fish. LOAELs ranged from 290 to 112,700 µg/kg ww for survival, growth, reproduction, and behavior endpoints. The CPG disagrees that that the lowest three LOAELs used in the species sensitivity distribution (SSD) are appropriate for assessing LPRSA baseline risks to fish. The lowest LOAEL of 290 µg/kg ww is based on data from Berlin et al. (1981)[48], wherein survival of lake trout was affected based on fish hatched from field-collected eggs from Lake Michigan with high concentrations of PCBs, total DDx, and mercury; the elevated tissue burdens of PCBs and other contaminants may have contributed to toxicity. The next lowest LOAEL of 550 µg/kg ww is based on data from Butler (1969)[49], wherein pinfish survival was affected; however, survival was not tissue concentration dependent. Finally, the third lowest LOAEL of 1,650 µg/kg ww is based on goldfish behavior (locomotor activity), as reported by Davy et al. (1972)[50], which is not a direct measure of survival, growth, or reproduction.

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[47] Beckvar N, Dillon TM, Read LB. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects thresholds. Environ Toxicol Chem 24(8):2094-2105.

[48] Berlin WH, Hesselberg RJ, Mac MJ. 1981. Growth and mortality of fry of Lake Michigan lake trout during chronic exposure to PCBs and DDE. In: Chlorinated hydrocarbons as a factor in the reproduction and survival of lake trout (*Salvelinus namaycush*) in Lake Michigan. Technical Paper 105. US Fish and Wildlife Service, Washington, DC.

[49] Butler PA. 1969. Significance of DDT residues in estuarine fauna. In: Miller MW, Berg GG, eds, Chemical fallout: current research on persistent pesticides. Charles C. Thomas, Springfield, IL, pp 205-220.

[50] Davy FB, Kleerekoper H, Gensler P. 1972. Effects of exposure to sublethal DDT on the locomotor behavior of the goldfish (*Carassius auratus*). J Fish Res Bd Can 29(9):1333-1336.

TEQ – The USEPA-directed NOAEL and LOAEL of 0.89 and 1.8 ng/kg ww, respectively, for TEQ in fish tissue are based on data presented in Couillard et al. (2011)[51], wherein mummichog were exposed to PCB-126. The USEPA-directed NOAEL and LOAEL are based on a study that did not measure tissue concentrations in mummichog; as stated in the revised FFS (Louis Berger et al. 2014)[52], tissue concentrations were linearly interpolated for topical doses of 25 and 50 pg/L based on one empirical data point (100 pg/L topical dose and a mean 710 ng/kg larvae tissue) measured in a previous study, Couillard et al. (2008)[53], as cited in Couillard et al. (2011)[54]. The FFS-reported tissue concentrations could not be replicated by the CPG, and there appears to be a discrepancy between units of the values selected from Couillard et al. (2011)[55] in the interpolation.

Methylmercury – The USEPA's methylmercury fish tissue TRVs are based on a 5[th] percentile LOAEL developed by Beckvar et al. (2005)[56] from data derived from the US Army Corps of Engineers (USACE) Environmental Residue Effects Database (ERED). The CPG disagrees that the USEPA-directed TRVs are appropriate for assessing baseline risks because of the inclusion of certain studies in the LOAEL TRV development that are not directly relevant to assessing LPRSA fish. As reported by Beckvar et al. (2005)[57], eight LOAELs were selected for seven species of fish to derive a mercury 5[th] percentile LOAEL. LOAELs ranged from 250 to 5,000 µg/kg ww for survival, growth, reproduction, and behavior endpoints. The CPG disagrees that the two lowest LOAELs used in the SSD are appropriate for assessing LPRSA baseline risks to fish. The lowest LOAEL of 250 µg/kg ww

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[51] Couillard CM, Legare B, Bernier A, Dionne Z. 2011. Embryonic exposure to environmentally relevant concentrations of PCB126 affects prey capture ability of *Fundulus heteroclitus* larvae. Mar Environ Res 71(4).
[52] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[53] Couillard CM, LeBeuf M, Legare B, Trottier S. 2008. Effects of diazinon on mummichog (*Fundulus heteroclitus*) larvae produced from eggs differentially treated with PCB126. Arch Environ Contam Toxicol 54:283-291.
[54] Couillard CM, Legare B, Bernier A, Dionne Z. 2011. Embryonic exposure to environmentally relevant concentrations of PCB126 affects prey capture ability of *Fundulus heteroclitus* larvae. Mar Environ Res 71(4).
[55] Couillard CM, Legare B, Bernier A, Dionne Z. 2011. Embryonic exposure to environmentally relevant concentrations of PCB126 affects prey capture ability of *Fundulus heteroclitus* larvae. Mar Environ Res 71(4).
[56] Beckvar N, Dillon TM, Read LB. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects thresholds. Environ Toxicol Chem 24(8):2094-2105.
[57] Beckvar N, Dillon TM, Read LB. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects thresholds. Environ Toxicol Chem 24(8):2094-2105.

is based on walleye reproduction as reported by Friedmann et al. (1996)[58]; however, the residue is based on a whole-body concentration minus the viscera, so it is unclear how representative the residue is of whole-body concentrations. The second lowest LOAEL of 300 µg/kg ww is based on striped mullet regeneration rates of amputated caudal fins (Weis and Weis 1978)[59], which is not a direct measure of growth, survival, or reproduction for fish under conditions in the LPRSA.

Copper – The USEPA-directed copper TRVs for fish tissue (a LOAEL and NOAEL of 1.5 and 0.32 mg/kg ww, respectively) are based on a mortality response in striped mullet (Zyadah and Abdel-Baky 2000)[60]. The CPG disagrees that these TRVs are appropriate for evaluating baseline ecological risks, since these values are even lower than the nutritionally optimal levels for fish, and an increase in tissue concentrations in fish was not correlated with an increased adverse effect.

Bird Egg TRVs

PCDD/PCDF, Total PCBs, PCB TEQ – Several USEPA-directed bird egg TRVs are inappropriate for assessing ecological risk because they are based on uncertain endpoints, receptors and toxicity data. The bird egg total PCB NOAEL and LOAEL—700 and 1,300 µg/kg ww, respectively—are based on an interpolated threshold that includes chicken reproduction (hatchability) toxicity (Chapman 2003)[61]. TRVs based on domestic reproductive endpoints are uncertain because domesticated species such as chickens (and quails) have altered egg-laying rates compared to wild bird species. For PCDD/PCDF and PCB TEQ, NOAEL and LOAEL values of 59 and 150 ng/kg ww, respectively, were directed by USEPA (Louis Berger et al. 2014)[62] based on an SSD 5th

[58] Friedmann AS, Watzin MC, Brinck-Johnson T, Leiter JC. 1996. Low levels of dietary methylmercury inhibit growth and gonadal development in juvenile walleye (*Stizostedion vitreum*). Aquat Toxicol 35(1996):265-278.
[59] Weis P, Weis JS. 1978. Methylmercury inhibition of fin regeneration in fishes and its interaction with salinity and cadmium. Estuar Coast Mar Sci 6:327-334.
[60] Zyadah MA, Abdel-Baky TE. 2000. Toxicity and bioaccumulation of copper, zinc, and cadmium in some aquatic organisms. Bull Environ Contam Toxicol 64:740-747.
[61] Chapman J. 2003. Memorandum dated March 6, 2003: Toxicity reference values (TRVs) for mammals and birds based on selected Aroclors. Ecologist, US Environmental Protection Agency Region 5, Chicago, IL.
[62] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

percentile from USEPA (2003a)[63]. These values include chicken reproduction. Domesticated species have unnaturally high egg-laying rates and toxicological and reproductive sensitivities that are very different from those of wild bird species. Comparing toxic threshold effects on reproductive endpoints for domesticated species with those for non-domesticated species is uncertain because of differences in reproductive physiology.

Dieldrin – The USEPA's directed bird egg dieldrin LOAEL and NOAEL TRVs of 8,100 and 200 µg/kg ww, respectively (Louis Berger et al. 2014)[64], are based on values reported by Mendenhall et al. (1983)[65]. Eggs with concentrations of 8,100 µg/kg ww were reported to have eggshell thickness reduced by 5.5%; however, Mendenhall et al. (1983)[66] reported that no reduction in breeding success was noted in this exposure group. The selected LOAEL is not associated with a clear adverse reproductive effect, therefore there is high uncertainty associated with these TRVs.

Total DDx – The USEPA-directed bird egg NOAEL and LOAEL TRVs of 500 and 3,000 µg/kg ww, respectively, for total DDx (Louis Berger et al. 2014)[67] based on data reported for DDx egg residues for brown pelican (Blus 1984)[68]. These TRVs are not appropriate because the use of field-collected egg data is uncertain in establishing a LOAEL given the other factors in the field potentially contributing to reproductive success (e.g., other contaminants and non-chemical stressors).

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[63] USEPA. 2003. Analyses of laboratory and field studies of reproductive toxicity in birds exposed to dioxin-like compounds for use in ecological risk assessment. EPA/600/R-03/114F. National Center for Environmental Assessment, US Environmental Protection Agency, Cincinnati, OH.

[64] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[65] Mendenhall VM, Klaas EE, McLane MAR. 1983. Breeding success of barn owls (*Tyto alba*) fed low levels of DDE and dieldrin. Arch Environ Contam Toxicol 12:235-240.

[66] Mendenhall VM, Klaas EE, McLane MAR. 1983. Breeding success of barn owls (*Tyto alba*) fed low levels of DDE and dieldrin. Arch Environ Contam Toxicol 12:235-240.

[67] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[68] Blus LJ. 1984. DDE in birds' eggs: comparison of two methods for estimating critical levels. Wilson Bull 96(2):268-276.

Bird Diet TRVs

Cadmium – The USEPA-directed cadmium bird diet LOAEL and NOAEL TRVs of 10.4 and 0.08 mg/kg bw/day, respectively (Battelle 2005)[69], are based on Richardson et al. (1974)[70] and USEPA (2002b)[71]. These TRVs are based on a cellular endpoint of testicular development and are not a direct measurement of survival, growth, or reproduction.

Copper – A LOAEL TRV of 4.7 mg/kg bw/day and a NOAEL TRV of 2.3 mg/kg bw/day were directed by USEPA for copper (Louis Berger et al. 2014)[72] based on USEPA's ecological soil screening level (Eco-SSL) document for copper USEPA (2007a)[73]. These TRVs were based on turkey growth using data from Kashani et al. (1986)[74]. The LOAEL TRV was based on a 4% decrease in body weight in turkeys compared to the control at 8 weeks, with a recovery in body weight at 12 weeks, and no effect on body weight at 12, 16, 20, or 24 weeks (Kashani et al. 1986)[75]. These results do not identify a level at which adverse effects would be expected and therefore are inappropriate for determining risk to receptors.

Nickel – The USEPA's directed TRVs are based on USEPA Region 9 Biological Technical Assistance Group (BTAG)-recommended TRVs for nickel in bird diet (USEPA 2002b)[76]. A

[69] Battelle. 2005. Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers. Battelle, Duxbury, MA.
[70] Richardson ME, Fox MRS, Bry BE, Jr. 1974. Pathological changes produced in Japanese quail by ingestion of cadmium. J Nutr 104:323-338.
[71] USEPA. 2002. US EPA Region 9 Biological Technical Assistance Group (BTAG) recommended toxicity reference values for mammals [online]. US Environmental Protection Agency Region 9, San Francisco, CA. Updated 11/21/02. Available from: http://www.dtsc.ca.gov/assessingrisk/upload/eco_btag-mammal-bird-trv-table.pdf.
[72] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[73] USEPA. 2007. Ecological soil screening levels for copper. Interim final. Revised February 2007. OSWER Directive 9285.7-68. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.
[74] Kashani AB, Samie H, Emerick RJ, Carlson CW. 1986. Effect of copper with three levels of sulfur containing amino acids in diets for turkeys. Poult Sci 65:1754-1759.
[75] Kashani AB, Samie H, Emerick RJ, Carlson CW. 1986. Effect of copper with three levels of sulfur containing amino acids in diets for turkeys. Poult Sci 65:1754-1759.
[76] USEPA. 2002. US EPA Region 9 Biological Technical Assistance Group (BTAG) recommended toxicity reference values for mammals [online]. US Environmental Protection Agency Region 9, San Francisco, CA. Updated 11/21/02. Available from: http://www.dtsc.ca.gov/assessingrisk/upload/eco_btag-mammal-bird-trv-table.pdf.

NOAEL and LOAEL of 1.38 and 56.3 mg/kg bw/day, respectively, were cited based on mallard growth using data from Cain and Pafford (1981)[77]. The CPG could not replicate these values, and they are inconsistent with the TRVs derived from this study as reported by Sample et al. (1996)[78].

Zinc – The USEPA directed zinc bird diet LOAEL and NOAEL TRVs of 172 and 17.2 mg/kg bw/day, respectively (Battelle 2005)[79], are based on data from Gasaway and Buss (1972)[80]. These TRVs are based on the endpoint of mallard gonadal weight, which is not a direct measurement of reproductive success. Furthermore, the CPG could not replicate these values. The CPG derived a LOAEL of 300 mg/kg bw/day from this same study based on the empirical data provided in the study.

Selenium – The USEPA-directed TRVs are based on USEPA Region 9 BTAG-recommended TRVs for selenium in bird diet (USEPA 2002b)[81]. A NOAEL and LOAEL of 0.23 and 0.93 mg selenium/kg bw/day, respectively, were cited based on the same study used by the CPG-selected TRVs (Heinz et al. 1989)[82]. The CPG could not replicate the USEPA's values, although it was able to derive very similar values (a NOAEL and LOAEL of 0.42 and 0.82 mg/kg bw/day, respectively). The CPG-derived TRVs from this study are the same as those reported by Sample et al. (1996)[83].

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77 Cain BW, Pafford EA. 1981. Effects of dietary nickel on survival and growth of mallard ducklings. Arch Environ Contam Toxicol 10:737-745.

78 Sample BE, Opresko DM, Suter GW. 1996. Toxicological benchmarks for wildlife. 1996 revision. ES/ERM-86/R3. Office of Environmental Management, US Department of Energy, Washington, DC.

79 Battelle. 2005. Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers. Battelle, Duxbury, MA.

80 Gasaway WC, Buss IO. 1972. Zinc toxicity in the mallard duck. J Wildl Manage 36:1107-1117.

81 USEPA. 2002. US EPA Region 9 Biological Technical Assistance Group (BTAG) recommended toxicity reference values for mammals [online]. US Environmental Protection Agency Region 9, San Francisco, CA. Updated 11/21/02. Available from: http://www.dtsc.ca.gov/assessingrisk/upload/eco_btag-mammal-bird-trv-table.pdf.

82 Heinz GH, Hoffman DJ, Gold LG. 1989. Impaired reproduction of mallards fed an organic form of selenium. J Wildl Manage 53(2):418-428.

83 Sample BE, Opresko DM, Suter GW. 1996. Toxicological benchmarks for wildlife. 1996 revision. ES/ERM-86/R3. Office of Environmental Management, US Department of Energy, Washington, DC.

Lead – NOAEL and LOAEL TRVs of 0.19 and 1.9 mg/kg bw/day, respectively, were selected for lead (Louis Berger et al. 2014)[84] based on USEPA's Eco-SSL document for lead USEPA (2005)[85]. These TRVs were based on Japanese quail egg production using data from Edens and Garlich (1983)[86]. TRVs based on domestic reproductive endpoints are considered highly uncertain because domesticated species (e.g., chickens and quails) are bred to have very high egg-laying rates, and it is not evident that effects noted in Japanese quail egg production rates would reflect adverse effects on reproduction in wild birds.

Mercury/methylmercury – The USEPA directed a TRV using a bird diet methylmercury NOAEL and LOAEL of 13 and 26 µg/kg bw/day, respectively (Louis Berger et al. 2014)[87], based on USEPA (1995)[88]. These TRVs were based on mallard reproduction using data from Heinz (1979, 1974, 1975)[89,90,91]. Uncertainty factors were used to derive the values (Louis Berger et al. 2014). The LOAEL TRV was derived from the reported LOAEL based on an interspecies extrapolation factor of three in Louis Berger et al. (2014)[92]. No rationale was provided for the assumption that mallard were three times less sensitive than the selected avian receptors. Additional uncertainty is associated with this TRV because it is based on the use of methylmercury dicyandiamide, a fungicide that is not a form of mercury expected to be associated with the LPRSA.

[84] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[85] USEPA. 2005. Ecological soil screening levels for lead. Interim final. OSWER Directive 9285.7-70. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.
[86] Edens FW, Garlich JD. 1983. Lead-induced egg production decrease in leghorn and Japanese quail hens. Poult Sci 62:1757-1763.
[87] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[88] USEPA. 1995. Great Lakes Water Quality Initiative criteria documents for the protection of wildlife: DDT, mercury, 2,3,7,8-TCDD, PCBs. EPA-820-B-95-008. Office of Water, US Environmental Protection Agency, Washington, DC.
[89] Heinz GH. 1979. Methylmercury: reproductive and behavioral effects on three generations of mallard ducks. J Wildl Manage 43(2):394-401.
[90] Heinz GH. 1974. Effects of low dietary levels of methyl mercury on mallard reproduction. Bull Environ Contam Toxicol 11(4):386-392.
[91] Heinz GH. 1975. Effects of methylmercury on approach and avoidance behavior of mallard ducklings. Bull Environ Contam Toxicol 13(5):554-564.
[92] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

LPAHs – NOAEL and LOAEL TRVs of 670 and 6,700 µg/kg bw/day, respectively, were directed by USEPA for LPAH (Louis Berger et al. 2014)[93]. These values were derived from Schafer et al. (1983)[94], wherein birds were exposed to individual LPAH compounds (acenaphthene, fluorene, phenanthrene, and anthracene) for 48 hrs to determine the acute LD50 (dose that is lethal to 50% of an exposed population) values. There is uncertainty associated with the application of a toxicity value for one PAH compound to a mixture of LPAHs, which assumes that the potency of all the individual compounds in the mixture are equivalent.

HPAHs – The USEPA-directed NOAEL and LOAEL TRVs of 48 and 480 µg/kg bw/day, respectively, were used for HPAHs (Louis Berger et al. 2014)[95] are derived from Hough et al. (1993)[96]. The effects observed were based on exposure to benzo(a)pyrene; uncertainty should be considered in applying a TRV from a single HPAH to a group of HPAHs. Other HPAHs are not known to be as toxic as benzo(a)pyrene, so the comparison of a dose of total HPAHs to a benchmark dose based on benzo(a)pyrene is highly conservative. In addition, an interspecies extrapolation factor of three was applied to derive the TRVs with no rationale for the assumption that pigeons were three times less sensitive than selected avian receptors (Louis Berger et al. 2014)[97]. The NOAEL was derived from the LOAEL based on a factor of 10. There is high uncertainty in these TRVs because they were derived from unsupported uncertainty factors.

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[93] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[94] Schafer EW, Jr, Bowles WA, Jr, Hurlbut J. 1983. The acute oral toxicity, repellency, and hazard potential of 998 chemicals to one or more species of wild and domestic birds. Arch Environ Contam Toxicol 12:355-382.

[95] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[96] Hough JL, Baird MB, Sfeir GT, Pacini CS, Darrow D, Wheelock C. 1993. Benzo(a)pyrene enhances atherosclerosis in white carneau and show racer pigeons. Arterioscler Thromb 13:1721-1727.

[97] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

PCDDs/PCDFs –USEPA-directed NOAEL and LOAEL TRVs of 2.8 and 28 ng/kg bw/day, respectively for TEQ (Louis Berger et al. 2014)[98] are based on USEPA (1995)[99]. These TRVs were cited based on pheasant reproduction using data from Nosek et al. (1992)[100]. The LOAEL was derived from the reported LOAEL using an interspecies extrapolation factor of five to account for data indicating that pheasants are not among the most sensitive species. This extrapolation factor is conservative based on the observation that chickens, which are in the high sensitivity group, had a LOAEL that was approximately one order of magnitude higher than the LOAEL for ring-necked pheasants for the same endpoint.

Total PCBs, PCB TEQ – USEPA directed bird diet NOAEL and LOAEL TRVs (400 and 500 µg/kg bw/day, respectively) are based on domestic reproductive endpoints, such as for total PCBs in the study by Chapman (2003)[101] cited by USEPA in the revised FFS, are uncertain because domesticated species such as chickens (and quails) have altered egg-laying rates compared to wild bird species. Consequently, the use of USEPA-directed bird diet TRVs for total PCBs is inappropriate and will significantly impact risk calculations. Additionally, adopting bird diet TRVs for total PCBs and PCB TEQ based on studies using an interspecies extrapolation, whereby the species are much more sensitive to dioxin-like compounds than receptors like great blue heron (studied by Nosek et al. (1992)[102] and cited in USEPA (1995)[103]), is inappropriate and results in over-conservative risk calculations.

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[98] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[99] USEPA. 1995. Great Lakes Water Quality Initiative criteria documents for the protection of wildlife: DDT, mercury, 2,3,7,8-TCDD, PCBs. EPA-820-B-95-008. Office of Water, US Environmental Protection Agency, Washington, DC.

[100] Nosek JA, Craven SR, Sullivan JR, Hurley SS, Peterson RE. 1992. Toxicity and reproductive effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in ring-necked pheasant hens. J Toxicol Environ Health 35:187-198.

[101] Chapman J. 2003. Memorandum dated March 6, 2003: Toxicity reference values (TRVs) for mammals and birds based on selected Aroclors. Ecologist, US Environmental Protection Agency Region 5, Chicago, IL.

[102] Nosek JA, Craven SR, Sullivan JR, Hurley SS, Peterson RE. 1992. Toxicity and reproductive effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in ring-necked pheasant hens. J Toxicol Environ Health 35:187-198.

[103] USEPA. 1995. Great Lakes Water Quality Initiative criteria documents for the protection of wildlife: DDT, mercury, 2,3,7,8-TCDD, PCBs. EPA-820-B-95-008. Office of Water, US Environmental Protection Agency, Washington, DC.

Total DDx – For the development of bird diet total DDx TRVs, USEPA directed the use of a LOAEL based on a study that is not controlled and for which effects could not be related to exposure to total DDx. USEPA directed the use of a NOAEL and LOAEL of 0.9 and 27 µg /kg bw/day, respectively, for total DDx (Louis Berger et al. 2014)[104] are based on USEPA (1995)[105]. These TRVs were cited based on pelican reproduction using data from Anderson et al. (1975)[106]. The LOAEL TRV of 27 µg/kg bw/day was based on results from a field study that compared observations about productivity and eggshell thinning to standards known to support a stable population (Anderson et al. 1975)[107]. No analysis was performed to determine the significance of changes (in eggshell thinning and productivity), and no consideration was given to the impacts that may have resulted from exposure to multiple chemicals, which is likely in field situations.

Mammal Diet TRVs

Arsenic – USEPA-directed arsenic mammal diet LOAEL and NOAEL TRVs of 4.7 and 0.32 mg/kg bw/day, respectively (Battelle 2005)[108],are based on USEPA (2002b)[109]. These TRVs are cited based on rat toxicity using data from Schroeder et al. (1968)[110] and Brown et al. (1976)[111]. These TRVs are based on a change in respiration rate, an endpoint that does not directly measure survival, growth, or reproduction.

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[104] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[105] USEPA. 1995. Great Lakes Water Quality Initiative criteria documents for the protection of wildlife: DDT, mercury, 2,3,7,8-TCDD, PCBs. EPA-820-B-95-008. Office of Water, US Environmental Protection Agency, Washington, DC.
[106] Anderson DW, Risebrough RW, Woods Jr LA, DeWeese LR, Edgecomb WG. 1975. Brown pelicans: improved reproduction off the southern California coast. Science 190:806-808.
[107] Anderson DW, Risebrough RW, Woods Jr LA, DeWeese LR, Edgecomb WG. 1975. Brown pelicans: improved reproduction off the southern California coast. Science 190:806-808.
[108] Battelle. 2005. Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers. Battelle, Duxbury, MA.
[109] USEPA. 2002. US EPA Region 9 Biological Technical Assistance Group (BTAG) recommended toxicity reference values for mammals [online]. US Environmental Protection Agency Region 9, San Francisco, CA. Updated 11/21/02. Available from: http://www.dtsc.ca.gov/assessingrisk/upload/eco_btag-mammal-bird-trv-table.pdf.
[110] Schroeder HA, Kanisawa M, Frost DV, Mitchener M. 1968. Germanium, tin and arsenic in rats: effects on growth, survival, pathological lesions and life span. J Nutr 96:37-45.
[111] Brown MM, Rhyne BC, Goyer RA. 1976. Intracellular effects of chronic arsenic administration on renal proximal tubule cells. J Toxicol Environ Health 1(3):505-514.

Cadmium – USEPA-directed NOAEL and LOAEL TRVs of 0.06 and 2.64 mg/kg bw/day for cadmium, respectively, are based on Richardson et al. (1974); Webster (1988)[112] and Schroeder and Mitchener (1971)[113]. This study is based on drinking water exposure, which is highly uncertain for evaluating the dietary exposure of LPRSA receptors.

Copper - The USEPA-directed mammal dietary TRVs for copper (a LOAEL and NOAEL of 6.8 and 3.4 mg/kg bw/day, respectively), are based on Aulerich et al. (1982)[114], and are inappropriate for assessing baseline ecological risks, because the LOAEL is not based on an actual adverse effect associated with a dose response.

Selenium – USEPA-directed selenium mammal diet LOAEL and NOAEL TRVs of 1.21 and 0.05 mg/kg bw/day, respectively (Battelle 2005)[115] are based on mouse toxicity using data from Harr et al. (1967)[116] and Schroeder & Mitchener (1971)[117]. The NOAEL value is not appropriate because it is based on liver toxicity, which is not a direct measure of survival, growth or reproduction.

Zinc – A LOAEL and NOAEL of 411 and 9.6 mg/kg bw/day, respectively, were directed by USEPA for zinc diet in mammals (Battelle 2005)[118] are based on USEPA (2002b)[119].

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112 Webster WS. 1988. Chronic cadmium exposure during pregnancy in the mouse: influence of exposure levels on fetal and maternal uptake. J Toxicol Environ Health Part A 24(2):183-192.

113 Schroeder HA, Mitchener M. 1971. Toxic effects of trace elements on the reproduction of mice and rats. Arch Environ Health 23:102-106.

114 Aulerich RJ, Ringer RK, Bleavins MR, Napolitano A. 1982. Effects of supplemental dietary copper on growth, reproductive performance and kit survival of standard dark mink and the acute toxicity of copper to mink. J Anim Sci 55(2):337-343.

116 Battelle. 2005. Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers. Battelle, Duxbury, MA.

117 Schroeder HA, Mitchener M. 1971. Toxic effects of trace elements on the reproduction of mice and rats. Arch Environ Health 23:102-106.

118 Battelle. 2005. Lower Passaic River Restoration Project. Pathways analysis report. Prepared for US Environmental Protection Agency Region 2 and US Army Corps of Engineers. Battelle, Duxbury, MA.

119 USEPA. 2002. US EPA Region 9 Biological Technical Assistance Group (BTAG) recommended toxicity reference values for mammals [online]. US Environmental Protection Agency Region 9, San Francisco, CA. Updated 11/21/02. Available from: http://www.dtsc.ca.gov/assessingrisk/upload/eco_btag-mammal-bird-trv-table.pdf.

These TRVs are based on rat and mouse toxicity using data from Aughey et al. (1977)[120] and Schlicker & Cox (1968)[121]. The NOAEL TRV is not appropriate because it is based on endocrine system changes, which are not a direct measure of survival, growth, or reproduction.

Lead – USEPA-directed NOAEL and LOAEL TRVs of 0.71 and 7.0 mg/kg bw/day for lead, respectively are based on Grant et al. (1980)[122]. This study is based on drinking water exposure, which is highly uncertain for evaluating the dietary exposure of LPRSA receptors.

Mercury/methylmercury – The CPG does not agree with USEPA's interpretation of the studies that USEPA used to derive the mammal diet NOAEL and LOAEL of 1.6 and 27 µg/kg bw/day, respectively, for mercury (Louis Berger et al. 2014)[123] based on data reported by USEPA (1995)[124]. These TRVs were based on mink reproduction using data from Wobeser et al. (1976a, b)[125],[126]. A sub-chronic-to-chronic factor of 10 was applied to the NOAEL and LOAEL. At the dietary dose of approximately 270 µg/kg bw/day, mink were fed 1.8 ppm mercury in their diet; sufficient information was not available to conclude that if the dietary concentrations had been reduced by a factor of 10 (to 0.18 ppm), effects would have been observed over a longer exposure period. In fact,

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[120] Aughey E, Grant L, Furman BL, Dryden WF. 1977. The effects of oral zinc supplementation in the mouse. J Comp Path 87:1-14.
[121] Schlicker SA, Cox DH. 1968. Maternal dietary zinc, and development and zinc, iron, and copper content of the rat fetus. J Nutr 95:287-294.
[122] Grant LD, Kimmel CA, West GL, Martinez-Vargas CM, Howard JL. 1980. Chronic low-level lead toxicity in the rat: II. Effects on postnatal physical and behavioral development. Toxicol Appl Pharmacol 56(1):42-58.
[123] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.
[124] USEPA. 1995. Great Lakes Water Quality Initiative criteria documents for the protection of wildlife: DDT, mercury, 2,3,7,8-TCDD, PCBs. EPA-820-B-95-008. Office of Water, US Environmental Protection Agency, Washington, DC.
[125] Wobeser G, Nielsen NO, Schiefer B. 1976. Mercury and mink I. The use of mercury contaminated fish as a food for ranch mink. Can J Comp Med 40:30-33.
[126] Wobeser G, Nielsen NO, Schiefer B. 1976. Mercury and mink II. Experimental methyl mercury intoxication. Can J Comp Med 40:34-45.

Wobeser et al. (1976a)[127] found that mink fed diets of up to 75% fish containing 0.44 ppm over a 145-day period suffered no effects.

Nickel – USEPA-directed NOAEL and LOAEL TRVs of 0.133 and 31.6 mg/kg bw/day for nickel, respectively, are based on Smith et al. (1993)[128]. This study is based on drinking water exposure, which is highly uncertain for evaluating the dietary exposure of LPRSA receptors.

HPAHs – A mammal diet NOAEL and LOAEL of 0.62 and 3.1 µg/kg bw/day, respectively, were directed for HPAHs (Louis Berger et al. 2014)[129] by USEPA based on USEPA's Eco-SSL document for PAHs (USEPA 2007b)[130]. These TRVs were derived based on mouse growth toxicity data as reported by Culp et al. (1998)[131]. Mice were exposed to a PAH mixture, but only the value for benzo(a)pyrene was used to calculate the TRV. Using the total PAH concentration from the study results in a NOAEL and LOAEL of 30 and 61 µg/kg bw/day, respectively. All HPAHs are not known to be as toxic as benzo(a)pyrene, so the comparison of a dose of total HPAHs to a benchmark dose based on benzo(a)pyrene is overly conservative.

PCDD/PCDFs and Total TEQ and PCB TEQ – USEPA directed a mammal diet NOAEL and LOAEL of 0.08 and 2.2 ng/kg bw/day, respectively, for TEQ (Louis Berger et al. 2014)[132]

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[127] Wobeser G, Nielsen NO, Schiefer B. 1976. Mercury and mink I. The use of mercury contaminated fish as a food for ranch mink. Can J Comp Med 40:30-33.

[128] Smith MK, George EL, Stober JA, Feng HA, Kimmel GL. 1993. Perinatal toxicity associated with nickel chloride exposure. Environ Res 61:200-211.

[129] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

[130] USEPA. 2007. Ecological soil screening levels for polycyclic aromatic hydrocarbons (PAHs). Interim final. OSWER Directive 9285.7-78. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.

[131] Culp SJ, Gaylor DW, Sheldon WG, Goldstein LS, Beland FA. 1998. A comparison of the tumors induced by coal tar and benzo[a]pyrene in a 2-year bioassay. Carcinogenesis 19(1):117-124.

[132] Louis Berger, Battelle, HDR. 2014. Focused feasibility study report for the lower eight miles of the Lower Passaic River. The Louis Berger Group, Battelle, and HDR/HydroQual.

based on Tillett et al. (1996)[133]. These TRVs were based on mink exposure to field-contaminated carp. Field-collected fish may have contained other contaminants; therefore, it is impossible to determine if impacts on the mink were solely due to PCDD exposure in their diet.

METALS AND TISSUE – INCONSISTENT WITH USEPA GUIDANCE AND BAD SCIENCE

CPG disagrees with USEPA's direction that a tissue residue approach for regulated metals should be used in the BERA. The use of a tissue residue approach for metals (except methylmercury and selenium[134]) is highly uncertain because of the wide range of strategies used by organisms to store, detoxify, and excrete bioaccumulated metals (e.g., fish and invertebrates may regulate their body burdens of some metals, although metals regulation, and the strategy thereof, is species and metal specific) (Adams et al. 2011; USEPA 2007c)[135,136]. The USEPA framework for metals risk assessment (USEPA 2007c)[137] also recommends against the use of a tissue residue approach, stating that the critical body residue (CBR) approach for metals "*does not appear to be a robust indicator of toxic dose.*"

As summarized from Adams et al. (2011),[138] total metals concentrations in whole-body tissue do not reflect the biologically or metabolically active portion of metal that is

[133] Tillitt DE, Gale RW, Meadows JC, Zajicek JL, Peterman PH, Heaton SN, Jones PD, Bursian SJ, Kubiak TJ, Giesy JP, Aulerich RJ. 1996. Dietary exposure of mink to carp from Saginaw Bay. 3. Characterization of dietary exposure to planar halogenated hydrocarbons, dioxin equivalents, and biomagnification. Environ Sci Technol 30:283-291.
[134] Selenium tissue residue TRVs based on dietary exposures include only those exposures that involved organic forms of selenium in the diet. Exposure to organic forms of selenium in the diet is the most environmentally relevant exposure (DeForest and Adams 2011).
[135] Adams W, Blust R, Borgmann U, Brix K, DeForest D, Green A, McGeer J, Meyer J, Paquin P, Rainbow P, Wood C. 2011. Utility of tissue residues for predicting effects of metals on aquatic organisms. Integr Environ Assess Manage 7(1):75-98.
[136] USEPA. 2007. Framework for metals risk assessment. EPA 120/R-07/001. Office of the Science Advisor, Risk Assessment Forum, US Environmental Protection Agency, Washington, DC.
[137] USEPA. 2007. Framework for metals risk assessment. EPA 120/R-07/001. Office of the Science Advisor, Risk Assessment Forum, US Environmental Protection Agency, Washington, DC.
[138] Adams W, Blust R, Borgmann U, Brix K, DeForest D, Green A, McGeer J, Meyer J, Paquin P, Rainbow P, Wood C. 2011. Utility of tissue residues for predicting effects of metals on aquatic organisms. Integr Environ Assess Manage 7(1):75-98.

available to contribute to toxicity at the site of action. Metals are transformed into different chemical species when they are transferred from one media to another, including within and between organisms in the food web, which may result in a multitude of metal species. Organismal uptake of metals requires more or less specific transporters that take the metal across the membranes separating the ambient from the intracellular environment (Simkiss and Taylor 2001)[139]. The specificity of the transporters limits the metal species taken up. For example, nutritionally essential calcium is mediated by specific transmembrane protein carriers and channels. Cadmium uptake and toxicity are mediated by these calcium transporters. The divalent cadmium ion (Cd^{2+}) resembles the divalent calcium ion (Ca^{2+}) in terms of radius and charge, thus allowing for Cd^{2+} uptake by Ca^{2+} transporters when other inorganic and organic cadmium species are excluded. Once taken up, internal transport, storage, detoxification, and elimination mechanisms further alter the metal species present and their distribution. Given the complexity of metal speciation in the environment and specificity of organismal uptake, the concentration of total metal in the organism is poorly predictive of the fraction of metabolically active metal at the site of toxic action.

Trace metal accumulation patterns differ among organisms and among metals, even for the same organism. Some organisms can accumulate rather high metal concentrations without apparent negative effects, whereas other organisms show signs of toxicity at much lower whole-body tissue concentrations. Metals in an organism can be metabolically active (and potentially toxic) or stored in non-toxic storage depots (Rainbow 2002, 2007)[140,141]. Thus, the same tissue residue that, in one case, results in an adverse effect can, in another case, be non-toxic (see e.g., Kraak et al. 1992; Andres et al. 1999; Hook and Fisher 2002)[142,143,144]. Furthermore, because internal fate and

[139] Simkiss K, Taylor MG. 2001. Trace element speciation at cell membranes: aqueous, solid and lipid phase effects. Journal of Environmental Monitoring 3:15-21.
[140] Rainbow PS. 2002. Trace metal concentrations in aquatic invertebrates: why and so what? Environ Pollut 120:497-507.
[141] Rainbow PS. 2007. Trace metal bioaccumulation: models, metabolic availability and toxicity. Environ Internat 33:576-582.
[142] Kraak MHS, Lavy D, Peeters WHM, Davids C. 1992. Chronic ecotoxicity of copper and cadmium to the zebra mussel *Dreissena polymorpha*. Arch Environ Contam Toxicol 23(3):363-369.

transport processes are rate-dependent, tissue burdens associated with the toxicity of metals to aquatic organisms strongly depend on exposure scenario and exposure time. Thus, differences in metal uptake, detoxification, metabolism, and elimination kinetics of the organisms further limit the utility of whole-body tissue concentrations in predicting risk.

The CPG disagrees and questions the judgement of the USEPA in directing this evaluation in its December 2015 responses to comments and subsequent discussions. Limiting the tissue residue evaluation for metals to only organic forms is consistent with the findings of the SETAC-sponsored Pellston Workshop entitled *The Tissue Residue Approach for Toxicity Assessment* (Meador et al. 2011)[145]. Adams et al. (2011)[146] summarized this workshop's conclusions on the utility of using whole-body tissue concentrations to predict the toxicity of metals. Adam et al. (2011)[152] stated that it is difficult to develop broadly applicable and reliable TRVs for fish or invertebrate tissue and metals (except methylmercury and selenium) and some additional organometallic chemicals (i.e., butlytins) because of the wide range of strategies used by these organisms to store, detoxify, and excrete bioaccumulated metals (e.g., fish and invertebrates may regulate their body burdens of some metals, although metals regulation, and the strategy thereof, is species and metal specific). This directive by USEPA is nothing more than another effort to inflate the number of preliminary COCs and create the impression that there is more ecological risk in the LPRSA than can be realistically anticipated.

Nonetheless, despite the weak and uncertain nature of this LOE, it is evaluated in the BERA and the uncertainty of the LOE is presented, as directed by USEPA.

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[143] Andres S, Baudrimont M, Lapaquellerie Y, Ribeyre F, Maillet N, Latouche C, Boudou A. 1999. Field transplantation of the freshwater bivalve *Corbicula fluminea* along a polymetallic contamination gradient (River Lot, France): I. Geochemical characteristics of the sampling sites and cadmium and zinc bioaccumulation kinetics. Environ Toxicol Chem 18(11):2462-2471.

[144] Hook SE, Fisher NS. 2002. Relating the reproductive toxicity of five ingested metals in calanoid copepods with sulfur affinity. Mar Environ Res 53:161-174.

[145] Meador J, Adams WJ, Escher BI, McCarty LS, McElroy AE, Sappington KG. 2011. The tissue residue approach for toxicity assessment: Findings and critical reviews from a Society of Environmental Toxicology and Chemistry Pellston workshop. Integr Environ Assess Manage 7(1):2-6.

[146] Adams W, Blust R, Borgmann U, Brix K, DeForest D, Green A, McGeer J, Meyer J, Paquin P, Rainbow P, Wood C. 2011. Utility of tissue residues for predicting effects of metals on aquatic organisms. Integr Environ Assess Manage 7(1):75-98.

COMMON CARP – AN INAPPROPRIATE ECOLOGICAL RECEPTOR

The USEPA's directive that common carp be evaluated as an ecological receptor and that the common carp tissue data be used as prey data in the revised BERA is without merit. The USEPA's statements and comments from December 2015, April 2016, and June 2016, culminating in its August 4, 2016, letter, are scientifically and technically unsound. The USEPA's decision that the common carp is not an invasive species principally relies on the fact that the State of New Jersey has not identified carp as an invasive species on its invasive species webpage. The common carp was not identified as an ecological receptor of concern (see Table 5-1) in the USEPA Region 2-approved August 2009 LPRSA Human Health and Ecological Risk Assessment Streamlined 2009 Problem Formulation – Final document. In addition, the USEPA's January 31, 2014, comments (Comment 8a) on the October 2013 *Revised Risk Analysis and Risk Characterization Plan for the Lower Passaic River Study Area* do not identify the common carp as an ecological receptor.

The CPG disagrees with USEPA's assertions made in paragraph 2 of its June 20, 2016, email that attempt to minimize the adverse impacts of common carp on aquatic environments. Moreover, the USEPA attempts to misconstrue and confuse this issue by suggesting that the literature is referring to other carp species (e.g., silver carp, Asian carp, bighead carp). The citations and references presented below are for the common carp and not the other species suggested by USEPA.

The USEPA's position on the common carp is not supported by the professional literature, nor by regulatory determinations made by other federal agencies and states. It is well-documented in the literature that common carp is a highly invasive species and that common carp can fundamentally modify the structure and function of aquatic ecosystems (Huser et al 2015)[147]. The US Fish and Wildlife Service (USFWS) has identified the common carp as an invasive and high risk species to the ecology of the waters of lower 48 states of the United States (USFWS 2014)[148]. Federal agencies

[147] Hydrobiologia 2015 Volume 754, 11 pp
[148] https://www.fws.gov/Fisheries/ANS/erss/highrisk/Cyprinus-carpio-WEB-09-10-2014.pdf

(including the USEPA's Partner Agencies), state agencies and international organizations have identified common carp as a highly invasive species with significant adverse impacts on the environments where they are introduced (USGS[149], NOAA[150], MN DNR[151], Invasive Species Specialist Group[152]).

Moreover, it is clear that the USEPA selectively cherry-picks the literature to support its positions on various technical issues. Specifically, in its June 2016 Exposure Depth Dispute Resolution, USEPA Region 2 relied on the 2015 Huser et al. paper to support a feeding/disturbance depth of up to 15 cm for common carp; however, USEPA ignores the established facts that common carp is an invasive species and its significant impact on its habitat. The introduction of the Huser et al. paper opens with the following two sentences:

> *"The common carp (Cyprinus carpio, or carp) is a large benthivorous fish from Eurasia that has been widely introduced to other regions over the past century and is considered to be one of the world's most invasive organisms (Kulhanek et al., 2011; Sorensen & Bajer, 2011). Researchers have long recognized that carp can fundamentally modify the structure and function of aquatic ecosystems (Cahn, 1929)."*

USEPA's position that common carp is not recognized as an invasive species in New Jersey is simply untrue and not supported (Attachments):

- USFWS has identified common carp as an invasive species present in the USFWS Wallkill River (a tributary to the Hudson River) Refuge (portions of the refuge are located in New Jersey). The Refuge's webpage specifically documents the common carp's adverse impacts: "*Feeding and spawning common carp* (Cyprinus carpio) *kill aquatic plants and increase water*

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149 http://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=4

150 http://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=4&Potential=N&Type=1&HUCNumber=DGreatLakes

151 http://www.dnr.state.mn.us/invasives/aquaticanimals/commoncarp/index.html

152 http://www.iucngisd.org/gisd/species.php?sc=60

turbidity, and as a result, Refuge waters provide poorer habitat for native fish"[153].

- In an October 3, 2016 article[154] discussing the dredging of Hughes Lake, Larry Hajna, a spokesman for the New Jersey Department of Environmental Protection, said *"The fish were removed, primarily bullhead catfish, and relocated to the Passaic River."* The article also attributes the following statement to Hajna *"that if carp were left behind it would be because they are considered an invasive species."* A review of the video accompanying the article includes pictures of several fish remaining in Hughes Lake that are clearly common carp. An October 10 2016 site visit to Hughes Lake found dead common carp in the lake bed.

The peer-reviewed scientific literature and, more importantly, current determinations made by the USFWS (an LPRSA Partner Agency) and other agencies conclusively establish that the common carp is a highly invasive species throughout the lower 48 states of the continental United States, including New Jersey.

As such, the common carp is an invasive species, despite the USEPA's August 4, 2016, letter, and remains an obvious candidate stressor within the LPRSA as defined in USEPA's 1998 risk assessment guidelines[155]:

"A stressor is any physical, chemical, or biological entity that can induce an adverse response. This term is used broadly to encompass entities that cause primary effects and those primary effects that can cause secondary (i.e., indirect) effects. Stressors may be chemical (e.g., toxics or nutrients), physical (e.g., dams, fishing nets, or suspended sediments), or biological (e.g., exotic or genetically engineered organisms)."

[153] https://www.fws.gov/refuge/Wallkill_River/wildlife_and_habitat/invasivespecies.html
[154] http://www.northjersey.com/news/improvement-project-makes-temporary-mess-of-picturesque-passaic-lake-1.1670895
[155] EPA/630/R-95/002F. April 1998 Guidelines for Ecological Risk Assessment (Published on May 14, 1998, Federal Register 63(93):26846-26924)

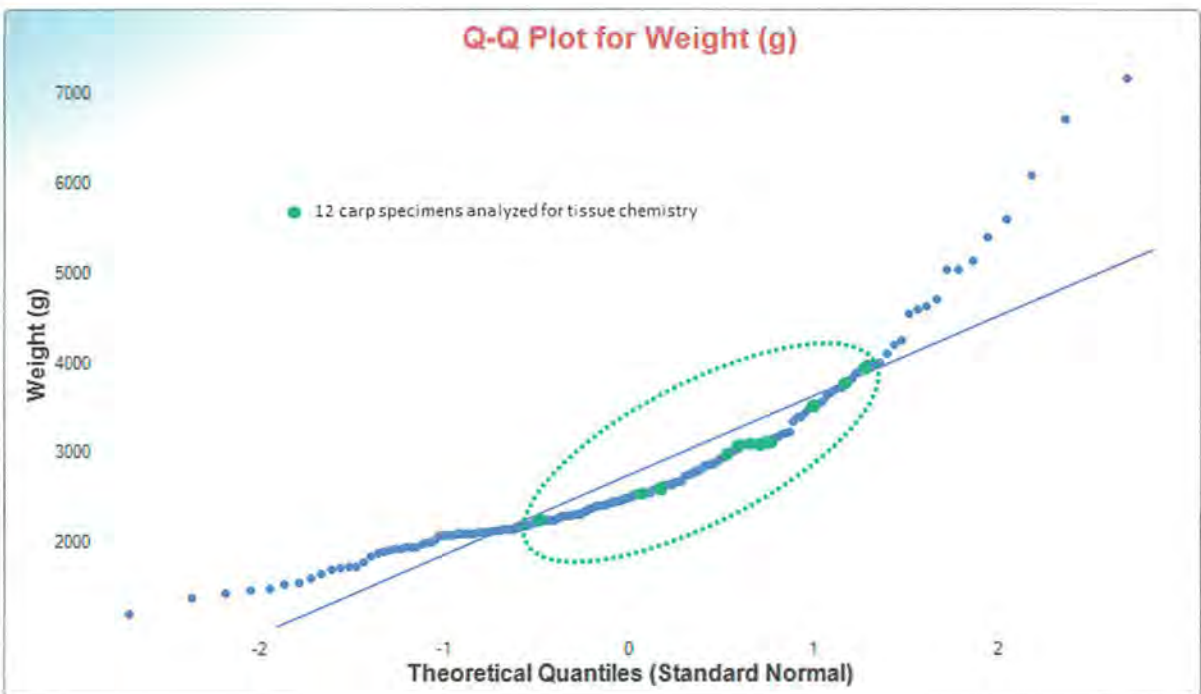
The USEPA's proposed language in its August 4, 2016, letter is purposely weak and is an obvious effort to minimize and mask the common carp's adverse impact as a primary biological stressor in the LPRSA aquatic environments. The biomass of common carp (caught during the 2009 and 2010 RI collections), as presented in the table below, is in most instances tens to hundreds of times greater compared to native species present in the LPRSA.

	Carp abundance in catch relative to other species by reach (biomass basis, carp in numerator)			
Species	**5**	**6**	**7**	**8**
American eel	19	57	159	9
Brown bullhead	-	86	478	191
Channel catfish	188	29	96	15
Common carp	1	1	1	1
Gizzard shad	94	344	478	38
White perch	34	69	239	48
White sucker	42	172	239	8

The USEPA's directives on the common carp result in risk estimates in hazard quotients (HQs) that are as high as 340 for 2,3,7,8-TCDD and PCDD/PCDF TEQ; these HQs are more than twice the HQs for other species and preliminary COCs. It is counterintuitive for the common carp to be the most abundant species present in the LPRSA based on biomass and have HQs that are significantly higher than other fish species. An obvious conclusion is that the risk to common carp is grossly overestimated and that common carp are not affected by chemistry to the degree that USEPA would have the public believe.

A substantial amount of stress and degradation to the LPRSA ecosystem (e.g., potentially including depressed abundance of native fish species, lack of macrophytes, elevated turbidity, increased nutrients, etc.) may be attributable, in part, to the dominating and adverse nature of the common carp. A known biological stressor such as the common carp should not be an ecological receptor evaluated in the BERA.

The CPG has previously agreed with USEPA and incorporated common carp as a prey fraction to piscivorous wildlife and avian receptors; this is consistent with what was done at other sites such as Portland Harbor. The CPG has done this despite the biased selection of carp specimens by USEPA, which overestimates levels of chemicals resulting in exaggerated risk to these receptors. USEPA directed the analysis of only large specimens (common carp > 2,000 g with proportionately higher tissue chemistry) for the BERA (see figures and table below), not specimens close to or within the size range (<450 grams) that the piscivorous birds are physically able to consume.




Max fish prey size for great blue heron
Max fish prey size for belted kingfisher
Min and max
Median
Size (cm)
0
10
20
30
40
50
60
70
Prey size
Mummichog
White perch
Smallmouth bass
Brown bullhead
White sucker
White catfish
American eel
Carp

Focal Species	Prey	Appropriate Prey	Supporting documentation/Notes
Great Blue Heron	≤ 13 cm	Yes	Great blue heron are reported to eat fish 5 to 30 cm in length (Vennesland and Butler 2011)[156], although the majority of their prey is smaller. Studies report that 95% of fish consumed by great blue heron were ≤ 25 cm in length (in Wisconsin), and fish ≤ 20 cm made up the majority of the diet (in Lake Erie great blue heron) (USEPA 1993)[157]. Note that including fish up to 30 cm excludes the following fish (see Figure 1): white sucker, white catfish, most eel, and common carp. Also, note that carp collected and analyzed from the LPRSA were generally two times the size of the maximum fish prey size consumed by great blue heron and were greater in weight (average carp weight = 3.1 kg) that great blue heron (average heron weight = 2.3 kg).
	≤ 30 cm	No	
	All fish species, including carp	No	No ecological basis to include fish > 30 cm
Belted Kingfisher	≤ 9 cm	Yes	Belted kingfisher are reported to eat fish 2.5 to 17.8 cm in length but generally less than 10 cm (Kelly et al. 2009; Salyer and Lagler 1946, as cited in Prose 1985)[158,159]. Fish greater than 12.7 cm are thought to be difficult for this species to swallow (Kelly et al. 2009)[160]. Note that including fish up to 18 cm excludes the following fish (see Figure 1): smallmouth bass, brown bullhead, white sucker, white catfish, American eel, and common carp.
	≤ 18 cm	No	
	All fish species, including carp	No	No ecological basis to include fish > 30 cm
Mink	≤ 30 cm	Yes	Mink may consume fish up to 70 cm, although their diet is

[156] Vennesland RG, Butler RW. 2011. Great blue heron (*Ardea herodias*). In: Poole A, ed, The birds of North America online. Cornell Laboratory of Ornithology, Ithaca, NY, Available from: http://bna.birds.cornell.edu/bna/species/025.
[157] USEPA. 1993. Wildlife exposure factors handbook. EPA/600/R-93/187a. Office of Research and Development, US Environmental Protection Agency, Washington, DC.
[158] Kelly JF, Bridge ES, Hamas MJ. 2009. Belted kingfisher (*Megaceryle alcyon*), The Birds of North American Online (Poole, A, Ed.) [online]. Cornell Laboratory of Ornithology, Ithaca, NY. Available from: http://bna.birds.cornell.edu/bna/species/084/articles/introduction.
[159] Prose BL. 1985. Habitat suitability index models: belted kingfisher. Biol Rep 82(10.87). US Fish and Wildlife Service, Washington, DC.
[160] Kelly JF, Bridge ES, Hamas MJ. 2009. Belted kingfisher (*Megaceryle alcyon*), The Birds of North American Online (Poole, A, Ed.) [online]. Cornell Laboratory of Ornithology, Ithaca, NY. Available from: http://bna.birds.cornell.edu/bna/species/084/articles/introduction.

Focal Species	Prey	Appropriate Prey	Supporting documentation/Notes
	≤ 70 cm (including carp)	Yes (uncertainty)	primarily fish ≤ 30 cm. The results of an analysis of scat from mink in Idaho showed that the mink diet consisted of fish ranging in length from 7 to 30 cm; neither largescale sucker nor northern squawfish, which ranged from 35 to 45 cm, were consumed (Melquist et al. 1981)[161]. Another study in Great Britain found that most fish consumed by mink were < 30 cm long, although some of the Northern pike consumed were up to 70 cm. However, northern pike were only 1.5% of the mink's diet, so the overall percentage of large fish consumed was small.
River otter	≤ 30 cm	Yes	River otter may consume fish up to 50 to70 cm in length, although their diet is primarily fish ≤ 30 cm (USEPA 2003b; Melquist et al. 1981)[162,163].
	≤ 70 cm (including carp)	Yes (uncertainty)	

The USEPA tried to support its directive by providing pictures that show that heron eat fish larger than their beak size, including fish up to 30 cm long for heron and up to 18 cm long for kingfisher. While common carp within this size range may be consumed by heron and kingfisher, the common carp collected from the LPRSA were in the range of 50 to 60 cm in length and were not realistic prey for these bird receptors. Their concentrations are not representative of exposure concentrations in smaller fish due to the larger body size as well as the longer exposure time of larger carp (carp can live up to 9 to 15 years in the wild (Werner 2004)[164]).

Common carp is an inappropriate ecological receptor because it is an invasive species and a biological stressor. Future risk management decisions for the LPRSA should not be

161 Melquist WE, Whitman JS, Hornocker MG. 1981. Resource partitioning and coexistence of sympatric mink and river otter populations. In: Chapman JA, Pursley D, eds, Worldwide Furbearer Conference Proceedings. Worldwide Furbearer Conference Inc, Frostburg, MD, pp 187-220.

162 USEPA. 2003. GE/Housatonic River site in New England. Rest of river ERA. Species profile: river otter [online]. US Environmental Protection Agency, Boston, MA. [Cited 1/26/11.] Available from: http://www.epa.gov/ne/ge/thesite/restofriver/reports/final_era/B%20-%20Focus%20Species%20Profiles/EcoRiskProfile_river_otter.pdf.

163 Melquist WE, Whitman JS, Hornocker MG. 1981. Resource partitioning and coexistence of sympatric mink and river otter populations. In: Chapman JA, Pursley D, eds, Worldwide Furbearer Conference Proceedings. Worldwide Furbearer Conference Inc, Frostburg, MD, pp 187-220.

164 Werner RG. 2004. Freshwater fishes of the northeastern United States: A field guide. Syracuse University Press, Syracuse, NY.

based on estimated risks to the common carp and HQs that are not appropriate or valid. It would also be consistent with the precedents of the Portland Harbor RI/FS, where common carp is not an ecological receptor of concern[165], and the 2003 Tittabawassee River Aquatic Ecological Risk Assessment[166], which did not identify carp as an ecological receptor of concern. At both these sites, the carp data were used for wildlife and avian prey data and as a surrogate data set.

BENTHIC INVERTEBRATE EVALUATION – SEDIMENT QUALITY TRIAD & REFERENCE DATA SCREENING – BIASED METHODOLOGY

USEPA directed the CPG to make changes that technically weakened the methodology for conducting the benthic community risk assessment. The required changes fundamentally altered the ability of the risk analysis to identify risks to the benthic community posed by hazardous substances. Two of the more egregious changes were the protocols required to censor the available reference area data sets, and the requirement to use LRM-derived thresholds to define sediment quality in the sediment chemistry LOE of the Sediment Quality Triad (SQT):

- Analysis of reference area data sets – In screening candidate reference area data to be used to define reference conditions for the LPRSA, the USEPA required that any candidate data record must be rejected if the toxicity response for the sediment toxicity test was greater than 20% mortality for estuarine reference area data or 25% mortality for freshwater reference area data. The intent of developing a reference conditions data set is to provide a basis to determine which, if any, of the effects on the benthic community are due to non-chemical characteristics (such as habitat, sediment grain size distribution, and total organic carbon content), and potential effects related to hazardous substances (both naturally occurring and from diffuse, anthropogenic sources). Indeed, the very purpose of developing a reference data set is to determine the effects that local conditions have on the benthic community so that the risk assessment can

[165] *"Carp is not an ROC for the ERA; whole-body fish tissue (i.e., carp) was analyzed for dioxin-like contaminants, including PCB congener analysis, and, for these contaminants, is a surrogate for other fish species."* From Footnote 3, Table 3-1, Portland Harbor RI/FS Final1 Remedial 'Investigation Report, Appendix G: BERA, December 16, 2013

[166] Submitted to Michigan Department of Environmental Quality, Remediation & Redevelopment Division, Saginaw Bay District Office in October 2003 By Galbraith Environmental Sciences LLC., Newfane, Vermont

be appropriately adjusted to exclude impacts that are not related to the unpermitted release of hazardous substances. The requirement to set, *a priori*, a toxicity threshold limit reflects a decision by USEPA to set an arbitrary, pre-determined value to define sediment quality conditions in the "without release" analysis, which is inconsistent with the purpose of defining a reference condition.

- Analysis of the sediment chemistry line of evidence using LRM derived values – The USEPA required the CPG to compare LPRSA sediment chemistry data to T20 and T50 values (derived using the LRM) for the sediment chemistry LOE. The purpose of each LOE, including toxicity data and benthic community metrics, is to present a clear, site-specific link to effects. For the toxicity data and the benthic community data, the link to effects is the use of reference data, but as discussed above, USEPA's required approach to selecting data sets to be used in defining reference conditions is flawed. The requirement to compare LPRSA bulk sediment chemistry data to the T20 and T50 values is also flawed. Dr. Jay Field, who was responsible for the development of the LRM model and its application, has noted that the *"LRM approach provides a useful framework for conducting screening-level assessments..."* and that the model does not consider site-specific bioavailability or exposure (Field et al. 2002)[167]. In directing the CPG to use of LRM-based thresholds, USEPA has merely required the CPG to conduct a screening-level comparison in the BERA, which is clearly inappropriate. It is worth noting that the comparison of T20 and T50 values to the LPRSA sediment chemistry data results in all LRPSA stations being defined as impacted, as might be expected in a screening-level process. The use of LRM-based thresholds in the sediment chemistry LOE does not address the magnitude of the relationship between concentration and "toxic" response, which is a requirement in differentiating potential impacts among LPRSA locations, since it is impossible possible to determine what level of effect (i.e., what magnitude of risk to invertebrates) can be expected based on a mere exceedance of T20 and T50 values. Furthermore, T50 values are unreliable as predictors of toxicity in the LPRSA (as determined using reliability statistics in Appendix P of the BERA). Based

[167] Field LJ, MacDonald DD, Norton SB, Ingersoll CG, Severn CG, Smorong D, Lindskoog R. 2002. Predicting amphipod toxicity from sediment chemistry using logistic regression models. Environ Toxicol Chem 21(9):1993–2005.

on a comparison of the toxicity threshold T50 values to LPRSA toxicity response data, the Type II error rate (false positive) ranged from 18 to 82%, demonstrating that the T50 values are unreliable in predicting when LPRSA sediment will be toxic.

These changes, along with the other changes to the SLERA and the BERA required by the USEPA, result in a BERA that is no more than a screening-level document, and is therefore unusable as a document to be used in decision-making.

EXTERNAL PEER REVIEW

The numerous directives imposed by the USEPA have severely compromised the objectivity and technical value of the current revision of the BERA. As such, the CPG is calling on USEPA Region 2 and USEPA Headquarters to convene and conduct an external peer review of the June 2014 version of the BERA. The June 2014 Draft BERA was a robust and technically sound assessment of the baseline ecological risk for the entire 17-mile LPRSA. The USEPA has failed in its obligations pursuant to the May 2007 AOC Section IX.37.f, which states, in part, the following:

> *"Consistent with the Peer Review Handbook (EPA/100/B-06/002), EPA will determine on a case-by-case basis which Lower Passaic River Restoration Project Work products should be peer reviewed, in accordance with the principle that all influential scientific and technical work products used in decision making will be peer reviewed. <u>At a minimum, the Model Calibration/Validation, Baseline Human Health Risk Assessment and Baseline Ecological Risk Assessment reports shall be peer reviewed."</u>* (emphasis added)

The USEPA should have conducted an external peer review of the 2014 BERA. The USEPA should comply with the principle and requirement elaborated in the 2007 AOC and conduct an external peer review of the June 2014 BERA. An external peer review of the June 2014 BERA is the only mechanism to resolve and remedy the technical deficiencies of the current version of the BERA resulting from the USEPA's directives since June 2015.

The CPG requests that this letter be included in the Administrative Records for the 17-mile LPRSA and 8-mile LPRSA operable units of the Diamond Alkali Superfund site. If you have any questions, please contact Bill Potter or me.

Very truly yours,

de maximis, inc.

Robert Law, Ph.D.
CPG Project Coordinator

cc:
Michael Sivak, USEPA Region
Walter Mugdan, USEPA Region 2
Frances Zizila, USEPA Region 2
Sarah Flangan, USEPA Region 2
CPG Members
William Hyatt, CPG Coordinating Counsel
Willard Potter, de maximis, inc.

ATTACHMENTS

Attachments

Invasive Species

Non-indigenous, invasive species are a serious threat to wildlife and habitats at Wallkill River Refuge. Exotic plants degrade habitat by converting diverse native plant communities into single-species monocultures, and introduced animals compete directly with native wildlife. In fact, invasive species are one of the most important threats to the National Wildlife Refuge System as a whole.

All refuge habitats and wildlife species are vulnerable to the effects of invasive species. Purple loosestrife and Phragmites have taken over many Refuge wetlands. Consequently, habitat for the federally-threatened bog turtle, migrating waterfowl, and a wide diversity of other wetland dependant wildlife has been degraded. Refuge grasslands are being invaded by Canada thistle and spotted knapweed (*Centaurea stoebe*). Shrublands are becoming dominated by multiflora rose, common buckthorn (*Rhamnus cathartica*), and autumn olive (*Elaeagnus umbellata*). Refuge forests have become invaded by tree-of-heaven (*Ailanthus altissima*), Japanese barberry, and garlic mustard. The introduced mute swan (*Cygnus olor*) competes with native waterfowl and marshbirds for food resources and nesting areas, and the feeding activities of these large birds damage wetland ecosystems. Feeding and spawning common carp (*Cyprinus carpio*) kill aquatic plants and increase water turbidity, and as a result, Refuge waters provide poorer habitat for native fish. Feral cats kill countless small mammals, ground-nesting birds, and songbirds. Other important invasive species on the Refuge include Japanese honeysuckle (*Lonicera japonica*), European bush-honeysuckles (*L. tatarica, L. morrowii*), Asiatic bittersweet (*Celastrus obiculatus*), Norway maple (*Acer platanoides*), Japanese knotweed (*Polygonum cuspidatum*), and gypsy moth (*Porthetria dispar*).

The refuge is currently participating in a Regional Invasive Plant Species inventory and Mapping Initiative. The purpose is to conduct a basic invasive plant inventory of refuge lands which will locate, identify, and map invasive plant species. This information will be used to guide development of control, monitoring, and evaluation initiatives.

Last Updated: Mar 22, 2013

NorthJersey.com

OCTOBER 3, 2016, 6:03 PM
LAST UPDATED: MONDAY, OCTOBER 3, 2016, 6:36 PM

Improvement project makes (temporary) mess of picturesque Passaic lake

BY RICHARD COWEN
STAFF WRITER | THE RECORD

The dredging of Hughes Lake is making a mess of Third Ward Memorial Park in Passaic, where dead fish lay scattered among the blobs of contaminated mud that been dredged up and deposited on the shoreline.

Joggers and strollers had to make their way around mounds of muck and step around the occasional dead eel lying in the grass Monday morning. The situation was more desperate for the oversized carp that live in Hughes Lake, which is now dry except for a narrow channel that cuts through the goo and leads beyond the dam and into a brook.

AMY NEWMAN/STAFF PHOTOGRAPHER

Passaic is dredging Hughes Lake in Veterans' Memorial Park, in order to make repairs and prevent future flooding.

The contractor, CMS Construction of Newark, was required by the state Department of Environmental Protection to remove fish from the lake before the dredging.

CMS cast nets into the water on Friday and Saturday to pull up fish, but the ones they didn't catch were still flopping about the channel on Monday.

"It's disgusting," observed Wally Padulo, 72, of Passic, as he walked his dog, Yankee, through the park on Monday morning. "But as my father used to say, 'to make anything better, you have to make it worse first.'"

Padulo walks his dog twice a day and despite the smell and dishevel, he has no plans of going anywhere else. "It's going to make the park nicer," he said.

Padulo said he saw the contractors casting nets into the lake on Friday to remove fish, and saw some neighborhood kids pitch in to help.

Complaints from residents prompted the DEP to send a conservation officer from the Division of Fish and Wildlife to the park on Monday. The officer was seen talking to CMS' foreman on the job, but didn't issue any summonses. The conservation officer declined to speak to a reporter.

Larry Hajna, a spokesman for the state Department of Environmental Protection, said CMS appeared to be in compliance with the permit and that it was normal protocol for the Division of Fish and Wildlife to check out the scene.

"The fish were removed, primarily bullhead catfish, and relocated to the Passaic River," Hajna said. He added that if carp were left behind it would be because they are considered an invasive species.

Carlos Dasilza, the foreman for CMS, estimated that "thousands" of fish were brought to the Passaic River, but not carp. "They're garbage," he said. "By law, you've got to kill them."

The draining of Hughes Lake has disturbed the landscape and upset the balance of nature. Flocks of Canada Geese have been pushed off the banks and deeper into the park; heron were perched at the mouth of the dam, plucking little fish from the channel as it connected with the brook. The joggers and strollers who seek the solitude of the park had to find a way around the noisy dump trucks that were billowing diesel smoke into the air.

Peter Kueken, a 55-year-old Passaic resident watched from a shady grove by the dam, where heron had landed to make the best of the situation. "I'm here because of this park," Kueken mused. "My parents met here. It's a love story."

The dredging of Hughes Lake is the centerpiece of a nearly $4 million flood control project at the 50-acre Third Ward Memorial Park, park, which is the largest patch of open space in Passaic. The crew has already rebuilt the retaining wall of McDanold'scq Brook, which feeds Hughes Lake. The next step is to dredge the lake down to a depth of about eight feet and stabilize the bank. The Hughes Lake dredging, which is Phase II of the project, is expected to be completed next spring.

The contaminated mud that is dredged from the lake will be carted away to landfills, CMS said.

Once Hughes Lake is fixed, the city plans to allow paddle boats and fishing to resume. Phases III and IV of the project involve dredging the section of the stream between the park and the Passaic River.

Funding for the project, which is estimated to cost $3.8 million, comes from a variety of state and county sources: $2 million from a federal community development block grant, $1.1 million from the state Green Acres program, $550,000 from the Passaic County Open Space trust fund, and a $100,000 dredging grant from the DEP.

Email:

Hughes Lake, Passaic, Passaic County, New Jersey

October 10, 2016

Narrative

Three dead common carp, *Cyprinus carpio*, were observed on the exposed banks of the lake's lower end. They were around twenty inches and would have weighed about five pounds each. On the video taken by the reporter for The Record, it was also common carp that were filmed. There was one carp variety filmed called a mirror carp. It is still a common carp, only with a genetic mutation that affects the scale pattern. The scales are larger and do not always completely cover the skin of the fish.

Besides goldfish and Koi (domestically bred common carp), the other carp species in North America (all introduced exotic invasives) are the grass, bighead and silver carp. These are considered potentially dangerous species by the state of New Jersey. Bighead carp have only been encountered rarely in NJ while silver carp have never been documented. Grass carp are known to exist in some water bodies of the state.

<table>
<tr><td colspan="2">AECOM</td><td>PHOTOGRAPHIC LOG</td></tr>
<tr><td>Photo No. 1</td><td>Date:
10/10/2016</td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:
West</td></tr>
<tr><td colspan="2">Description:
Dredging Hughes Lake, Passaic, NJ</td></tr>
</table>

AECOM

PHOTOGRAPHIC LOG

Photo No. 2	Date: 10/10/2016	
Direction Photo Taken: East		
Description: Three Common Carp along shoreline of Hughes Lake		

AECOM	PHOTOGRAPHIC LOG	
Photo No. 3	Date: 10/10/2016	
Direction Photo Taken: East		
Description: Dead Common Carp (Cyprinus carpio) on bank of Hughes Lake		

AECOM	PHOTOGRAPHIC LOG	
Photo No. 4	Date: 10/10/2016	
Direction Photo Taken: South		
Description: Remaining water in Hughes Lake		